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**PATENT**
**Attorney Docket No.: SP00-118**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| Inventor: | Bumgarner, Kirk P et al. | |
| Serial No: | 09/558,770 | Examiner: Hoffman, John M |
| Filing Date: | 04/26/2000 | Group Art Unit: 1731 |
| Title: | An Optical Fiber And A Method For Fabricating A Low Polarization-Mode Dispersion And Low Attenuation Optical Fiber | |

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**AMENDED BRIEF ON APPEAL**

This Amended Brief supports the appeal to the Board of Patent Appeals and Interferences from the final rejection dated January 10, 2005, in the application listed above. Appellant filed the Notice of Appeal on April 11, 2005. Appellant now submits this Amended Brief in response to the Examiner's Notification of Non-Compliant Appeal Brief as required by 37 C.F.R. § 41.37.

## I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Corning Incorporated.

## II. RELATED APPEALS AND INTERFERENCES

With respect to the related appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal, there are no such appeals or interferences.

## III. STATUS OF CLAIMS

On April 11, 2005 appellant appealed from the final rejections of claims 1-6, 12-14, 22-23, and 100-102 which were rejected in the final Office Action dated January 10, 2005. Those are the pending claims that are the subject of this Appeal and are set forth in the attached Appendix. Claims 7-11, 15-21, and 24-99, were withdrawn from consideration as is noted in the Examiner's non-final Office Action mailed on 02/18/04.

## IV. STATUS OF AMENDMENTS

There are no amendments that have not been entered by the Examiner. The last amendment to the claims was made in the Amendment and Response which was filed on December 1, 2004.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 relates to a method of manufacturing an optical fiber which provides for a cylindrical glass object 70, 55 having a wall defining a cylindrical hole 60, the center of the hole being positioned along the centerline of the glass object (page 6, lines 8-12, and page 13, lines 20-22). While the wall is not expressly described in the detailed description, the wall can be seen, for example, in Fig. 3 (see the dotted line which shows the wall that forms cylindrical hole 60). The glass object 55, 70 is heated to a temperature sufficient to reduce the outside diameter of the glass object 55 (see page 15, lines 21-24, and page 20, lines 5-8). A pressure of greater than or equal to 500 Torr is applied to the hole 60 (see page 20, lines 27-31) so as to reduce the outside diameter of the glass object 70, 55 by at least 1/3 and under conditions to close the hole 60 uniformly and symmetrically (see page 26, line 16 through page 17, line 11, and claim 1 as originally filed).

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The claims are currently rejected by the Patent Office as follows:

1) Claims 1-6, 12-14, 22-23, and 100-102 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
2) Claims 1, 3-5, and 100-102 are rejected under 35 U.S.C. §103(a) as being unpatentable over Onishi (U.S. Patent No. 6,076,376) alone or in view of Glodis (U.S. Patent No. 6,105,396).
3) Claims 1, 2, 6, 22-23, and 100-102 are rejected under 35 U.S.C. §103(a) as being unpatentable over Maurer (U.S. Reissue No. 28,028).
4) Claims 1-2, 6, and 100-102 are rejected under 35 U.S.C. §103(a) as being unpatentable over Berkey (U.S. Patent No. 5,152,818).
5) Claims 1-2, 12-14, and 22-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Berkey (U.S. Patent No. 5,917,109).

## VII. ARGUMENT

The rejection of Claims 1-6, 12-14, 22-23, and 100-102 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention) is improper

According to the Patent Office, "Claim 1 has no explicit step of making a fiber- although the preamble indicates that a fiber is made."

As the court stated in In re Borkowski, 164 USPQ 642 (CCPA 1970). "if the scope of the subject matter embraced by a claim is clear, and if the Applicant has not otherwise indicated that he intends the claim to be of a different scope, then the claim does particularly point out and distinctly claim the subject matter which the Applicant regards as his invention."

Applicants submit that each of the steps included in claim 1 are very easy to understand by one of skill in the art. Claim 1 requires the steps of:

providing a cylindrical intermediate glass object for use in the manufacture of optical fiber, the glass object having an wall defining a cylindrical hole, the center of the hole positioned along the centerline of the glass object;

heating the glass object to a temperature sufficient to reduce the outside diameter of the glass object;

applying a pressure of greater than or equal to 500 Torr to the hole; and

reducing the outside diameter of the glass object by at least 1/3 and under conditions sufficient to cause the hole to close uniformly and symmetrically.

All of these steps appear that they would be easy for one of skill in the art to understand.

Claim 3 likewise appears to be easily understood by anyone of skill in the art. In particular, claim 3 requires drawing a single mode optical fiber using said glass object, wherein said step of providing the glass object includes providing the glass object as an intermediate glass object suitable for making a single mode optical fiber, and wherein said step of reducing the outside diameter includes applying a pressure to the centerline hole which is great enough such that, during said drawing step, the glass layers around the centerline of the fiber are sufficiently symmetric so that said fiber exhibits a polarization mode dispersion value which is less than 0.2 ps/sqrt km, when said fiber is in an unspun state.

Consequently, if a single mode fiber is drawn from the glass object, and if the glass layers around the centerline of the fiber are sufficiently symmetric so that the fiber exhibits a PMD less than 0.2 ps/sqrt km when the fiber is in an unspun state, then claim is met.

The Examiner indicates that "there is confusing antecedent basis for the step "to make said single mode optical fiber" line 7, claim 3". Applicants respectfully disagree, as this language does not seem to appear in line 7 of claim 3. Likewise, the Examiner indicates that "the term "internal wall" is indefinite as to its meaning." Applicants submit that this terminology is likewise no longer present in claim 1.

The Examiner indicated in a Notification of Non-Compliant Appeal Brief dated August 2, 2005, that "the rejection regarding "wall" was not addressed – however the part regarding "internal" need not be addressed." According to the Examiner in the Final Rejection dated Jan 10, 2005:

"Applicant indicates that the tube is a wall. Examiner is not so sure such is true. But if it is a wall, it is unclear as to why it is an internal wall. The description of the invention is lacking to a degree that one would not be able

to reasonably tell if a particular tube wall is an internal wall or just a plain, non-internal wall."

Applicants submit that claim 1 has been amended to remove the word "internal" (See amendment dated Dec. 1, 2004), and consequently this rejection has been overcome. Applicants further submit that one of skill in the art will understand the meaning of the term "wall". The Examiner indicates in the Notification of Non-Compliant Appeal Brief that "It is noted that since Applicant failed to point out (in the response of 6 Dec. 2004) why the amendment overcame the rejection – that the basis for the rejection was still present." Applicants find this note by the Examiner confusing. On the one hand, the Examiner indicates that "internal" need not be addressed, but on the other hand the Examiner indicates the rejection of "wall" needs to be addressed, yet the rejection of the "wall" is based largely on the word "internal". In any event, applicants submit that one of skill in the art will know what a wall is, and in particular one of skill in the art will understand what is meant by a wall defining a cylindrical hole, particularly if they see Fig. 3.

The rejection of claims 1, 3-5, and 100-102 under 35 U.S.C. §103(a) as being unpatentable over Onishi (U.S. Patent No. 6,076,376) alone or in view of Glodis (U.S. Patent No. 6,105,396) is improper

A proper *prima facie* showing of obviousness requires the examiner to satisfy three requirements. First the prior art relied upon, coupled with knowledge generally available to one of ordinary skill in the art, must contain some suggestion which would have motivated the skilled artisan to combine references. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Second, the Examiner must show that, at the time the invention was made, the proposed modification had a reasonable expectation of success. See Amgen v. Chugai Pharm. Co., 927 F.2d 1200, 1209, 18 USPQ2d 1016, 1023 (Fed. Cir. 1991). Finally the combination of references must teach or suggest each and every limitation of the claimed invention. See In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

The Patent Office cites Onishi as disclosing that a preform can be made by MCVD or a rod and tube method, each of which require the provision of a glass object having a centerline hole. The hole is removed by heating in both the MCVD and the rod and tube method, and the diameter is reduced by at least one-third during the drawing step.

According to the Patent Office, "It would have been obvious to use a pressure at least equal to atmospheric pressure (in the Onishi MCVD process), to prevent atmospheric pressure from collapsing the tube. One of ordinary skill understands that there has to be a balance of pressures to prevent the tube from shrinking." Applicants respectfully disagree. In fact, prior art hole closure processes that applicants are familiar with involve using considerable vacuum to pull the centerline hole of the optical fiber preform closed. Such vacuums are employed for example, in MCVD processes. There is no teaching in Onishi of using any type of hole closure technique at all prior to drawing the fiber illustrated in Fig. 12, nor is there any suggestion of a hole closure technique that will result in symmetric hole closure.

Instead, Onishi is clearly directed to spinning the fiber to reduce the PMD in the optical fiber, whereas applicants' invention is a method which reduces the PMD in a fiber without having to spin the fiber. While applicants' invention can be used in conjunction with spinning techniques to reduce the PMD even further, the fact that applicant is able to achieve such low PMD without having to spin the fiber, as was necessary in Onishi, evidences the surprising improvement that applicant's invention enables.

According to the Patent Office, "Glodis is cited as teaching to keep a pressure in an MCVD tube to prevent a change in diameter (column 5, lines 45-47)." This teaching thus contradicts the statement by the Patent Office with respect to Onishi that "The diameter is reduced by at least one-third during drawing." Obviously, if the diameter is kept the same, it is not reduced. Consequently, applicants do not understand how the combination of Glodis and Onishi can result in a diameter reduction, as the Examiner himself admits that Glodis maintains the pressure in the tube to <u>prevent</u> a change in diameter.

The Patent Office indicates that it would have been obvious in view of Glodis to use a pressure at least equal to atmospheric to prevent atmospheric pressure from collapsing the tube in the Onishi MCVD process. As explained above, there is no clear teaching, or even a suggestion, in Onishi that a hole closure process was utilized to manufacture the fibers referred to by the Examiner (Figure 12). Furthermore, Glodis, if anything, teaches that the tube diameter should not be reduced. Consequently, the combination of Glodis with Onishi appears to be improper, and would not result in applicant's claimed invention as defined by claim 1.

With respect to claims 3-4, the Examiner states that "It is deemed that both pressures

(i.e. externally and internally) applied are "sufficient" to meet the stated condition." The Examiner gives no indication of why it is so deemed. Applicants submit that there must be some teaching or suggestion in the references that the processes disclosed in those references will result in a fiber which exhibits a PMD value which is less than 0.2 ps/sqrt km when the fiber is an unspun state (less than .01 ps/√km with respect to claim 4). Neither of these PMD values are mentioned or suggested by either of the references cited by the Examiner. In fact, as mentioned above, Onishi clearly deals with a spun fiber not unspun. The Examiner indicates that "Figure 12 of Onishi clearly shows that the fiber has the low dispersion values for at least some locations. Also other locations have unspun lengths: the spinning oscillates between positive locations and negative locations." Applicants submit that the Examiner misinterprets Figure 12. In fact, Figure 12 shows the PMD which is achieved using various swing periods, i.e. the x axis is not a length of a single particular fiber. Instead, Figure 12 shows the resultant PMD which is achieved for a particular fiber using various periods of spinning.

The Examiner indicates that the Office is "interpreting the claim to be "if the fiber is unspun then ..." the claim does not limit spun fibers. The claim does not require the re-creation of an unspun fiber." Applicants submit that claim 3 requires the fiber to exhibit a particular PMD without having to be or prior to being spun. In other words, as the fiber comes off the draw it will exhibit that PMD without spinning. Obviously, if the fiber is spun, the PMD can be even lower.

Claim 5 requires providing the intermediate glass object as a single mode optical fiber intermediate glass object, and wherein said step of reducing the outside diameter includes applying a pressure to the centerline hole which is great enough to achieve sufficiently symmetric layers of glass around the centerline of the fiber to result in a polarization mode dispersion value, in the resultant optical fiber, which is less than 0.05 ps/sqrt km and said fiber exhibits less than 3 spin rotations over a longitudinal fiber length of 1 meter. No such method or resultant optical fiber is mentioned or suggested in the references cited.

With respect to claims 101-102, there is no mention or suggestion in Onishi or Glodis of applying a pressure of greater than 750 Torr to the hole as required by claim 100. Likewise, there is no mention or suggestion in the art cited of drawing an optical fiber comprised of concentric layers such that any glass layer between .8 to .15 microns from the centerline of the fiber exhibits a change in radial dimension around its periphery which is less

than .025 microns. Likewise, as required by claim 102, there is no mention or suggestion of having such change in radial dimension which is less than .015 microns.

For at least the reasons given above, Appellants assert that the Examiner has failed to make a *prima facie* case of obviousness, and that the Board should reverse the §103 rejection and find that claims 1, 3-5, and 100-102 are allowable over the prior art of record.

<u>The rejection of claims 1, 2, 6, 22-23, and 100-102 are rejected under 35 U.S.C. §103(a) as being unpatentable over Maurer (U.S. Reissue No. 28,028) is improper.</u>

According to the Patent Office, "Figure 1 shows the intermediate glass object with a hole. The heating and reducing are clearly represented." While the Examiner admits that there is no indication of a pressure in the void and there is no indication the process has the bore exposed to atmospheric pressure. However, according to the Examiner it would have been obvious to perform the process at a pressure of at least atmospheric, so that one does not have to bother with a vacuum system. Applicants respectfully disagree and submit that no indication teaching in Maurer which would lead one to believe that one should void the vacuum system during the hole closure process, nor is there any teaching in Maurer that would lead one to believe that removal of the vacuum system would result in a process that still works to close the bore. Even if it were obvious to try such a pressure as is required by claim 1, it is not obvious from the teachings of Maurer that such a pressure could be made to work.

According to the Patent Office, "It is deemed that the reducing is done uniformly and symmetrically to the degree that is sufficient for the Maurer purpose. Also see column 3, lines 30-32, and column 6, lines 13-15. Alternatively, it would have been obvious to do the drawing as uniformly and as symmetrically as possible because variations in the core diameter might significantly effect the transmission characteristics as Maurer teaches." Applicants respectfully disagree. There is no mention or suggestion in Maurer of a process which would cause the hole to close symmetrically, nor is there any mention or suggestion of applying a pressure of greater than or equal to 500 Torr to the hole. Even if it were obvious to try such a pressure, it is not obvious that such a pressure would work. The Examiner must show that, at the time the invention was made, the proposed modification had a reasonable expectation of success. <u>See</u> <u>Amgen v. Chugai Pharm. Co.</u>, 927 F.2d 1200, 1209, 18 USPQ2d 1016, 1023 (Fed. Cir. 1991).

With respect to claim 2, the Patent Office merely indicates that "Claim 2 is clearly met." Applicants respectfully disagree. There is no mention or suggestion in Maurer of making the outside diameter of the optical fiber preform sufficiently large with respect to the centerline hole so that during the drawing operation the centerline hole completely closes when a pressure of greater than or equal to 500 Torr is applied to the hole (as described in independent claim 1).

With respect to claim 6, the Patent Office indicates that it would have been obvious to plug or cap the tube so as to prevent any material from getting into the tube. Applicants respectfully disagree. There is no mention or suggestion in Maurer that would lead one to plug the tube. The Patent Office indicates that column 4, lines 71-72, and column 7, lines 34-37, provide motivation to modify the teachings of Maurer accordingly. Applicants respectfully disagree. The portion at column 4 indicates that hydrochloric acid washing is desirable, and the portion at column 7 indicates that core and cladding materials need to be of very pure material. However, there is no mention or suggestion that the hole in the Maurer preform should be plugged or closed.

With respect to claims 22 and 23, the Patent Office indicates that "it would have been obvious to maintain the circular symmetry shown in figure 3, because there is no reason to change it, and because Maurer teaches variations are undesirable." Applicants respectfully disagree. The portion of Maurer at column 3, lines 30-32 indicate that "variations in core diameter or in either index of refraction may significantly effect the transmission characteristics of a waveguide." This passage is addressed to core diameter, not core symmetry. This does not suggest to one of skill in the art that the hole of the preform should be close to symmetrical as possible. This perhaps indicates that if one draws an optical fiber from the same preform but at different diameters, the transmission characteristics of the waveguide will change considerably. For example, if one optical fiber is drawn from a preform at 125μm diameter and another fiber is drawn from the same preform at 140 μm diameter, this will result in the core diameter changing and will typically significantly change the dispersion characteristics of the optical fiber. This is not the same as maintaining the circular symmetry of the core.

With respect to claim 100, there is no mention or suggestion in Maurer of applying a pressure of greater than 750 Torr to the hole as required by claim 100.

With respect to claims 101-102, the Patent Office indicates that "as per column 7,

lines 14-16 there is no layer between 0.08 and 0.15 microns. It is just a solid core within that range. The claim is only directed to the invention that has a layer there and does not limit a method which lacks a layer there." Applicants respectfully do not understand this comment by the Patent Office. Applicants submit that claims 101-102 are patentable over the prior art cited, as there is no mention or suggestion in the art cited of drawing an optical fiber comprised of concentric layers such that any glass layer between .8 to .15 microns from the centerline of the fiber exhibits a change in radial dimension around its periphery which is less than .025 microns. Likewise, as required by claim 102, there is no mention or suggestion of having such change in radial dimension which is less than .015 microns.

For at least the reasons given above, Appellants assert that the Examiner has failed to make a *prima facie* case of obviousness, and that the Board should reverse the §103 rejection and find that claims 1, 2, 6, 22-23, and 100-102 are allowable over the prior art of record.

The rejection of claims 1-2, 6, and 100-102 under 35 U.S.C. §103(a) as being unpatentable over Berkey (U.S. Patent No. 5,152,818) is improper

Berkey does not mention or suggest using an intermediate glass object which has a hole therein, the center of the hole positioned along the centerline of the glass object. Instead, feature 80 which is referred to by the Examiner in Figures 9-10 and 14 of Berkey, shows a hole which is located off of the centerline of the glass object. According to the Examiner, a centerline can be a real or imaginary line that is equal distant from the surface of sides of something. Thus, the Examiner seems to be taking a position that 80 in Figure 10 is a centerline hole. Applicants respectfully disagree and submit that anyone of skill in the art reading the specification as a whole would understand that applicants mean the centerline of the optical fiber preform which will in turn become the centerline of the optical fiber. See for example, page 3, lines 12-13 which discuss a cylindrical glass core blank having an axial hole along its centerline. Clearly this talks about the core blank. Page 3, lines 17 through page 4, line 7 discuss that the closure of such holes which are located along the centerline of the optical fiber preform can be closed non-symmetrically when the use of a vacuum forces, such as are used in the prior art references disclosed by the Examiner, are employed. It is clear from a reading of the specification as a whole that centerline hole as described in the claims means a hole along the centerline of the glass object, not the center of the hole, as the Examiner has apparently taken the position in the rejection over Berkey (5,152,818). According to the Patent Office, it would have been obvious to have the hole close uniformly

and symmetrically along the centerline access, so that the fiber will have the same cross-section at every location along its length. Applicants disagree with this statement. Holes can close extremely non-uniformly and non-symmetrically along the centerline axis and the fiber will still achieve the same cross-sectional dimension at every location along its length. This is further evidence of the surprising results of applicant's invention, which was not mentioned or suggested in any of the references cited by the Examiner.

With respect to claim 2, there is no mention or suggestion in the reference cited of making the outside diameter of the optical fiber preform sufficiently large with respect to the centerline hole so that during the drawing operation the centerline hole completely closes when a pressure of greater than or equal to 500 Torr is applied to the hole (as described in independent claim 1).

With respect to claim 100, there is no mention or suggestion in Berkey of applying a pressure of greater than 750 Torr to the hole as required by claim 100. Even if it were obvious to try such a pressure, it is not obvious that such a pressure could be made to work in view of the teachings in Berkey. The Examiner must show that, at the time the invention was made, the proposed modification had a reasonable expectation of success. See Amgen v. Chugai Pharm. Co., 927 F.2d 1200, 1209, 18 USPQ2d 1016, 1023 (Fed. Cir. 1991).

With respect to claims 101-102, there is no mention or suggestion in the art cited of drawing an optical fiber comprised of concentric layers such that any glass layer between .8 to .15 microns from the centerline of the fiber exhibits a change in radial dimension around its periphery which is less than .025 microns. Likewise, as required by claim 102, there is no mention or suggestion of having such change in radial dimension which is less than .015 microns.

The Patent Office indicates that "per column 13, lines 56-57, there is no layer between 0.08 and 0.15 microns. It is just a solid core within that range." Applicants submit that it is not clear how the Examiner knows this to be true, and request the Examiner to explain how he is certain that there are no layers present in the example 1 from Berkey 5,152,818. As far as applicants are aware, fibers are made of deposited layers of glass or deposited layers of soot that are consolidated into glass, in either case which layers can be seen when the fiber is viewed under an electron microscope.

For at least the reasons given above, Appellants assert that the Examiner has failed to make a *prima facie* case of obviousness, and that the Board should reverse the §103 rejection

and find that claims 1-2, 6, and 100-102 are allowable over the prior art of record.

The rejection of claims 1-2, 12-14, and 22-23 35 U.S.C. §103(a) as being unpatentable over Berkey (U.S. Patent No. 5,917,109) is improper

Berkey 5917109 does not disclose reducing the outside diameter of the glass object while applying a pressure of greater than or equal to 500 Torr to a centerline hole, under conditions sufficient to cause the hole to close uniformly and symmetrically. As the Examiner admits, Berkey does not disclose the claimed pressure. As explained above, it is not obvious to maintain an pressure of greater or equal to 500 Torr in a process which is aimed at closing a hole in an optical fiber perform. Even if it were obvious to try such a pressure, it is not obvious that such a pressure would work. The Examiner must show that, at the time the invention was made, the proposed modification had a reasonable expectation of success. See Amgen v. Chugai Pharm. Co., 927 F.2d 1200, 1209, 18 USPQ2d 1016, 1023 (Fed. Cir. 1991).

With respect to claim 2, there is no mention or suggestion in the reference cited of making the outside diameter of the optical fiber preform sufficiently large with respect to the centerline hole so that during the drawing operation the centerline hole completely closes when a pressure of greater than or equal to 500 Torr is applied to the hole (as described in independent claim 1). With respect to claim 22, there is no mention or suggestion of such a method or the resultant optical fiber as described by claim 2 and further defined by claim 22 which depends therefrom, namely which has substantial circular symmetry of glass layers along its centerline.

With respect to claim 23, there is no mention or suggestion of closing the hole such that the fiber exhibits a radial symmetry of less than .025 μm. According to the Examiner, it would have been obvious to have the fibers as close to symmetrical as possible so that the fibers possess the desired profile of Figure 7 or 8 at every position. Applicants disagree with this statement, as it is very common for optical fibers to be made such that they are not as symmetric as possible, because the degree of non-symmetry does not substantially affect the properties of the optical fiber. For example, the likely cause of the high amount of PMD in the Onishi fiber prior to spinning is due to asymmetry in the fiber. One common way to mitigate the non-symmetry is to spin the fiber, as Onishi suggests, to lower the PMD of the fiber. Applicants invention is directed to a new technique for lowering the PMD resulting in

the fiber from non-symmetric hole closure, i.e., closing the hole uniformly and symmetrically so that a low level of PMD can be achieved.

For at least the reasons given above, Appellants assert that the Examiner has failed to make a *prima facie* case of obviousness, and that the Board should reverse the §103 rejection and find that claims 1-2, 12-14, and 22-23 35_are allowable over the prior art of record.

## Conclusion

In conclusion, Appellants request a reversal of each of the grounds of rejection maintained by the Examiner and prompt allowance of the pending claims 1-6, 12-14, 22-23, and 100-102.

Please charge the fees due under 37 C.F.R. § 1.17(c) to Deposit Account No. 03-3325. If there are any other fees due in connection with the filing of this Brief on Appeal, please charge the fees to our Deposit Account No. 03-3325. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such an extension is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,

Dated: August 18, 2005

By:

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CERTIFICATE OF MAILING (37 CFR 1.8a)
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope Addressed to: Mail Stop Appeal Brief, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on August 18, 2005.

Robert L. Carlson

## VIII. CLAIMS APPENDIX

The claims on appeal are as follows:

1. (rejected) A method of manufacturing an optical fiber, comprising the steps of:

providing a cylindrical intermediate glass object for use in the manufacture of optical fiber, the glass object having an wall defining a cylindrical hole, the center of the hole positioned along the centerline of the glass object;

heating the glass object to a temperature sufficient to reduce the outside diameter of the glass object;

applying a pressure of greater than or equal to 500 Torr to the hole; and

reducing the outside diameter of the glass object by at least 1/3 and under conditions sufficient to cause the hole to close uniformly and symmetrically.

2. (rejected) The method of claim 1, wherein said step of providing the intermediate glass object includes providing the intermediate glass object as an optical fiber preform to a draw furnace, and wherein said step of reducing the outside diameter of said glass object includes drawing an optical fiber from the optical fiber preform, and wherein the outside diameter of the optical fiber preform is sufficiently large with respect to the centerline hole so that during said drawing optical fiber step the centerline hole completely closes.

3. (rejected) The method of claim 1 further comprising drawing a single mode optical fiber using said glass object, wherein said step of providing the glass object includes providing the glass object as an intermediate glass object suitable for making a single mode optical fiber, and wherein said step of reducing the outside diameter includes applying a pressure to the centerline hole which is great enough such that, during said drawing step, the glass layers around the centerline of the fiber are sufficiently symmetric so that said fiber exhibits a polarization mode dispersion value which is less than 0.2 ps/sqrt km, when said fiber is in an unspun state.

4. (rejected) The method of claim 3, wherein said step of providing the glass object includes providing the intermediate glass object as a single mode optical fiber intermediate glass

object, and wherein said step of reducing the outside diameter includes applying a pressure to the centerline hole which is great enough to achieve sufficiently symmetric layers of glass around the centerline of the fiber to result in a polarization mode dispersion value of less than 0.1 ps/sqrt km and said fiber exhibits less than 3 spin rotations over a longitudinal fiber length of 1 meter.

5. (rejected) The method of claim 1, further comprising drawing an optical fiber, wherein said step of providing the glass object includes providing the intermediate glass object as a single mode optical fiber intermediate glass object, and wherein said step of reducing the outside diameter includes applying a pressure to the centerline hole which is great enough to achieve sufficiently symmetric layers of glass around the centerline of the fiber to result in a polarization mode dispersion value, in the resultant optical fiber, which is less than 0.05 ps/sqrt km and said fiber exhibits less than 3 spin rotations over a longitudinal fiber length of 1 meter.

6. (rejected) The method of claim 2, wherein prior to said step of providing said preform to said draw furnace, at least one end of said hole is plugged.

7. (withdrawn) The method of claim 2, wherein said step of providing the glass object comprises providing a centerline hole that is plugged at both ends thereof preventing gas flow therethrough, and wherein, prior to said applying a pressure step, one end of the glass object is opened, thereby exposing the centerline hole to said pressure.

8. (withdrawn) The method of claim 7, wherein the step of providing the glass object plugged at both ends protects the centerline of the glass object sufficiently such that the attenuation of the resultant optical waveguide fiber is equal to or less than 0.24 dB/km at 1550 nm.

9. (withdrawn) The method of claim 7, wherein the attenuation of the resultant optical waveguide fiber is less than 0.22 dB/km at 1550 nm.

10. (withdrawn) The method of claim 7, wherein the attenuation of the resultant optical

waveguide fiber is less than 0.21 dB/km at 1550 nm.

11. (withdrawn) The method of claim 2, further comprising:
    forming the intermediate glass object by depositing glass or glass soot on the inside of a tube.

12. (rejected) The method of claim 2, further comprising:
    forming the intermediate glass object by depositing glass or glass soot onto the outside of a mandrel;
    removing the mandrel to form the hole; and
    heating the soot core blank to form a glass core blank.

13. (rejectedl) The method of claim 12, further comprising:
    redrawing the glass core blank to form a core cane, and during said redrawing step maintaining the centerline hole in the core cane; and
    forming the intermediate glass object from the core cane.

14. (rejected) The method of claim 13, wherein said step of forming the intermediate glass object includes overlaying or depositing a cladding material onto the core cane.

15. (withdrawn) The method of claim 14, further comprising:
    sealing shut both ends of the cane subsequent to said redrawing step and prior to said overlaying or depositing step.

16. (withdrawn) The method of claim 15, further comprising:
    positioning the optical fiber preform in a draw furnace, and unsealing one end of said centerline hole prior to said drawing step, and drawing a fiber from the other end of said fiber preform.

17. (withdrawn) The method of claim 14, further comprising:
    sealing shut both ends of the glass core blank prior to said redrawing step.

18. (withdrawn) The method of claim 1, wherein said step of providing the intermediate glass object includes providing the intermediate glass object as an intermediate glass object for making a multimode optical fiber, and said method further comprises drawing a multimode optical fiber from said intermediate glass object.

19. (withdrawn) The method of claim 18, further comprising:

providing a soot core blank;

consolidating the soot core blank into a glass body having a centerline hole therein; and

depositing additional soot onto said glass body.

20. (withdrawn) The method of claim 19, further comprising:

redrawing the glass body into a more narrow diameter prior to the deposition of additional soot.

21. (withdrawn) The method of claim 19, further comprising:

forming the intermediate glass object by depositing glass or glass soot onto the outside of a mandrel;

removing the mandrel to form the centerline hole; and

heating the soot core blank to form a glass core blank.

22. (rejectedl) The method of claim 2, wherein the optical fiber has a centerline and has a substantially circular symmetry of glass layers along its centerline.

23. (rejected) The method of claim 22, wherein at a distance of 0.1 microns from the centerline of said fiber, said fiber exhibits a radial symmetry of less than .025 microns.

24. (withdrawn) A single mode optical fiber, comprising:

a fiber core of layers of glass, said fiber core having a centerline; and

a fiber cladding surrounding said fiber core, wherein the layers of glass surrounding the centerline are sufficiently circularly symmetric to result in a polarization mode dispersion of less than 0.2 psec/sqrt-km.

25. (withdrawn) The optical fiber of claim 24, wherein said fiber has less than about 3 spin rotations over a longitudinal fiber length of 1 meter.

26. (withdrawn) The fiber of claim 24, wherein said fiber is in a substantially unspun state.

27. (withdrawn) The optical fiber of claim 24, wherein said fiber is comprised of:
concentric layers of glass; and
any glass layer between about .08 to about .15 microns from the centerline exhibits a change in radial dimension around its periphery which is less than .025 microns.

28. (withdrawn) The optical fiber of claim 27, wherein said change in radial dimension is less than .015 microns.

29. (withdrawn) The optical fiber in claim 27, wherein said optical fiber exhibits a polarization mode dispersion value of less than 0.2 psec/sqrt-km.

30. (withdrawn) The optical fiber of claim 27, wherein said optical fiber exhibits a polarization mode dispersion value of less than 0.1 psec/sqrt-km.

31. (withdrawn) A method of fabricating an optical waveguide fiber, comprising:
providing a cylindrical glass fiber preform having a longitudinally extending centerline hole;
plugging a first end and a second end of the centerline hole to prevent gas flow therethrough;
attaching an outer handle to the first end of the preform, the outer handle having a mating end;
providing an inner handle for coupling to a gas supply, the inner handle having a mating end and a fluid receiving end;
coupling the mating end of the outer handle with the mating end of the inner handle;
exposing the centerline hole of the preform to a gas;

heating the preform to a temperature sufficient to soften the preform; and
closing the centerline hole of the preform by drawing the preform into an optical waveguide fiber.

32. (withdrawn) The method of claim 31, wherein the step of exposing the centerline hole of the preform includes breaking the first end of the glass body.

33. (withdrawn) The method of claim 32, wherein the step of providing an inner handle includes providing a breaking tab within the inner handle to contact the bent tab of the preform when the outer handle and the inner handle rotate relative to one another, and wherein said step of exposing the centerline hole of the preform includes rotating the outer handle and the inner handle relative to one another until the breaking tab of the inner handle breaks the bent tab of the preform.

34. (withdrawn) The method of claim 33, and further including:
drawing a vacuum on the outer handle and the exposed centerline hole of the preform subsequent to said step of exposing the centerline hole of the preform; and
backfilling the outer handle and the centerline hole of the preform with the gas.

35. (withdrawn) The method of claim 34, and further including:
heating the glass body sufficiently to increase the gas pressure within the centerline hole of the glass body prior to said step of exposing the centerline hole of the preform.

36. (withdrawn) The method of claim 34, and further including:
flooding the ambient air surrounding the fluid receiving end of the inner handle with the gas prior to said step of exposing the centerline hole of the preform; and
uncoupling the outer handle and the inner handle prior to said step of closing the centerline hole.

37. (withdrawn) The method of claim 34, wherein the step of backfilling the outer handle and the centerline hole of the preform with the gas includes backfilling the inner and the outer handle and the centerline hole of the preform with a dry gas.

38. (withdrawn) The method of claim 33, and further including:

heating the preform sufficiently to increase the gas pressure within the centerline hole of the preform.

39. (withdrawn) The method of claim 33, and further including:

flooding the ambient air surrounding the fluid receiving end of the outer handle with a drying gas prior to said step of exposing the centerline hole of the preform; and

uncoupling the outer handle and the inner handle prior to said step of closing the centerline hole.

40. (withdrawn) The method of claim 33, wherein the step of exposing the centerline hole of the glass body includes exposing the centerline hole of the glass body to a dry gas.

41. (withdrawn) The method of claim 33, wherein the step of exposing the centerline hole of the glass body includes exposing the centerline hole of the glass body to a drying gas.

42. (withdrawn) The method of claim 33, and further including:

drawing a vacuum on the inner handle prior to said step of exposing the centerline hole of the preform; and

backfilling the inner handle with a drying gas.

43. (withdrawn) The method of claim 42, and further including:

heating the preform sufficiently to increase the gas pressure within the centerline hole of the glass body prior to said step of exposing the centerline hole of the preform.

44. (withdrawn) The method of claim 42, further including:

flooding the ambient air surrounding the fluid receiving end of the outer handle with the gas prior to said step of exposing the centerline hole of the preform; and

uncoupling the outer handle and the inner handle prior to said step of closing the centerline hole.

45. (withdrawn) The method according to claim 42, wherein the step of backfilling the outer handle with the gas includes providing the gas as a dry gas.

46. (withdrawn) The method according to claim 42, wherein the step of backfilling the outer handle with the gas includes providing the gas as a drying gas.

47. (withdrawn) The method of claim 42, wherein the step of backfilling the outer handle with the gas includes providing an exhaust port and passing the gas over the fluid receiving end of the inner handle enroute to the exhaust port.

48. (withdrawn) The method of claim 47, and further including:

providing a one way valve in fluid communication with the exhaust port.

49. (withdrawn) The method of claim 48, wherein said step of providing a one way flow valve includes providing a fluid filled bubbler.

50. (withdrawn) The method of claim 48, wherein the step of providing a one way flow valve includes providing a tube sufficiently long so as to prevent back flow of ambient air from reaching the fluid receiving end of the inner handle.

51. (withdrawn) The method of claim 50, wherein the step of backfilling the outer handle and the centerline hole of the glass body with the gas includes backfilling the outer handle and the centerline hole of the glass body with a drying gas.

52. (withdrawn) The method of claim 50, wherein the step of plugging both ends of the centerline hole of the glass fiber preform sufficiently protects the centerline hole from contamination such that the attenuation of the resultant waveguide fiber is equal to or less than 0.24 dB/km at 1550 nm.

53. (withdrawn) The method of claim 52, wherein the attenuation of the resultant optical waveguide fiber is less than 0.22 dB/km at 1550 nm.

54. (withdrawn) The method of claim 53, wherein the attenuation of the resultant optical waveguide fiber is less than 0.21 dB/km at 1550 nm.

55. (withdrawn) A preform for manufacturing an optical fiber comprising:

a cylindrical glass body having a longitudinally extending axial aperture;

a plug at a first end of said body to seal a first end of the axial aperture; and

a bent glass tab enclosing the opposite end of the axial aperture, said tab including a radially extending section and a longitudinally extending tip which can be fractured for exposing the axial aperture.

56. (withdrawn) The preform of claim 55 and further including a generally cup-shaped handle integrally formed on said glass body with said tab within the handle.

57. (withdrawn) The preform of claim 56 and further including a cylindrical conduit having an end mating with said cup-shaped handle and a radially inwardly extending breaking tab having a length which allows the breaking tab to engage and fracture the bent glass tab when the conduit and handle are rotated relative to one another.

58. (withdrawn) An optical fiber including a fiber core constructed of layers of glass and having a centerline, and a fiber cladding surrounding the fiber core, wherein the layers of glass surrounding the centerline are sufficiently circularly symmetric to result in a polarization mode dispersion of less than 0.2 psec/sqrt-km, made in accordance with a method comprising the steps of:

providing an intermediate glass object for use in the manufacture of optical fiber, the glass object having a hole therein at least one end of which is plugged preventing gas flow therethrough;

heating the glass object to a temperature sufficient to reduce the outside diameter of the glass object;

applying a pressure of equal to greater than 8 Torr to the void; and

reducing the outside diameter of the glass object and causing the hole or annular void to close uniformly and symmetrically.

59. (withdrawn) The optical fiber of claim 58, wherein said step of applying pressure includes applying a pressure of less than or equal to 100 Torr.

60. (withdrawn) The optical fiber of claim 59, wherein said step of applying pressure includes applying a pressure of less than or equal to 500 Torr.

61. (withdrawn) The optical fiber of claim 60, wherein said step of applying pressure includes applying a pressure of less than or equal to 750 Torr.

62. (withdrawn) The optical fiber of claim 61, wherein said step of applying pressure includes applying a pressure of less than or equal to 760 Torr.

63. (withdrawn) The optical fiber of claim 62, wherein said step of applying pressure includes applying a pressure of greater than 760 Torr.

64. (withdrawn) The optical fiber of claim 58, wherein the fiber exhibits less than 3 spin rotations over a longitudinal fiber length of 1 meter.

65. (withdrawn) The fiber of claim 58, wherein the fiber is in a substantially unspun state.

66. (withdrawn) The optical fiber of claim 58, wherein the fiber is comprised of:

concentric layers of glass; and

any glass layer located between about .8 to about 1.5 microns from the centerline exhibits a radial thickness which is less than .25 microns.

67. (withdrawn) The optical fiber of claim 66, wherein the radial thickness is less than .15 microns.

68. (withdrawn) The optical fiber of claim 66, wherein the optical fiber has a polarization mode dispersion value of less than 0.2 psec/sqrt-km.

69. (withdrawn) The optical fiber of claim 66, wherein the optical fiber has a polarization mode dispersion value of less than 0.1 psec/sqrt-km.

70. (withdrawn) The optical fiber of claim 66, wherein the optical fiber has a polarization mode dispersion value of less than 0.05 psec/sqrt-km.

71. (withdrawn) An optical fiber including a fiber core having an attenuation of less than or equal to 0.24 dB/km at 1550 nm, made in accordance with a method comprising the steps of:

providing an intermediate glass object for use in the manufacture of optical fiber, the glass object having a centerline hole therein each end of which is plugged preventing gas flow therethrough;

heating the glass object to a temperature sufficient to reduce the outside diameter of the glass object;

opening at least one end of the glass object while protecting the centerline hole from contamination; and

reducing the outside diameter of the glass object and causing the hole or annular void to close uniformly and symmetrically.

72. (withdrawn) The optical fiber of claim 71, wherein the intermediate glass object was formed by a method which comprises:

forming a soot core blank by depositing glass or glass soot onto a mandrel;

removing the mandrel to form the centerline hole; and

heating the soot core blank to form a glass core blank.

73. (withdrawn) The optical fiber of claim 72, wherein the method of forming the intermediate glass object further includes:

plugging both ends of the centerline hole of the soot core blank prior to heating the soot core blank to form a glass core blank.

74. (withdrawn) The optical fiber of claim 73, wherein the attenuation is less than or equal to 0.22 dB/km at 1550 nm.

75. (withdrawn) An optical fiber including a fiber core constructed of layers of glass and having a centerline, and a fiber cladding surrounding the fiber core, wherein the layers of glass surrounding the centerline are sufficiently circularly symmetric to result in a polarization mode dispersion of less than 0.2 psec/sqrt-km, and having an attenuation of less than or equal to 0.24 dB/km at 1550 nm, made in accordance with a method comprising the steps of:

providing an intermediate glass object for use in the manufacture of optical fiber, the glass object having a centerline hole therein each end of which is plugged preventing gas flow therethrough;

heating the glass object to a temperature sufficient to reduce the outside diameter of the glass object;

opening at least one end of the glass object while protecting the centerline hole from contamination;

applying a pressure of equal to or greater than about 8 Torr to the void; and

reducing the outside diameter of the glass object and causing the hole or annular void to close uniformly and symmetrically.

76. (withdrawn) The optical fiber of claim 75, wherein the step of applying the pressure includes applying a pressure of greater than or equal to 100 Torr.

77. (withdrawn) The optical fiber of claim 76, wherein the step of applying the pressure includes applying a pressure of greater than or equal to 500 Torr.

78. (withdrawn) The optical fiber of claim 77, wherein the step of applying the pressure includes applying a pressure of greater than or equal to 750 Torr.

79. (withdrawn) The optical fiber of claim 78, wherein the step of applying the pressure includes applying a pressure of greater than 760 Torr.

80. (withdrawn) The optical fiber of claim 79, wherein the fiber exhibits attenuation less than or equal to 0.22 dB/km at 1550 nm.

81. (withdrawn) The optical fiber of claim 80, wherein the fiber exhibits attenuation less than or equal to 0.21 dB/km at 1550 nm.

82. (withdrawn) The optical fiber of claim 75, wherein the fiber exhibits attenuation less than or equal to 0.21 dB/km at 1550 nm.

83. (withdrawn) A method of making an optical fiber, comprising:

forming an optical fiber preform via a process which comprises deposition of glass soot onto a substrate, removing the substrate and consolidating the preform to form a intermediate glass object having a centerline hole therein for use in the manufacture of optical fiber, and closing the hole under conditions suitable to close the hole under a pressure inside said centerline hole which is greater than 1 Torr.

84. (withdrawn) The method of claim 83, wherein the intermediate glass object is an optical fiber preform and the method, further comprising drawing said preform into an optical fiber.

85. (withdrawn) The method of claim 84, wherein said hole closing step takes place during said step of drawing the preform into an optical fiber.

86. (withdrawn) The method of claim 84, wherein the pressure inside the centerline hole is greater than 8 Torr.

87. (withdrawn) The method of claim 84, wherein the pressure inside the centerline hole is greater than 100 Torr.

88. (withdrawn) The method of claim 84, wherein the pressure inside the centerline hole is greater than 760 Torr.

89. (withdrawn) The method of claim 83, wherein said hole closure step comprises closing the hole via a process which comprises exposure of said intermediate glass object to a heat source which symmetrical surrounds said intermediate glass object.

90. (withdrawn) The method of claim 89, wherein said hole closing step comprises closing the hole in a cylindrical furnace.

91. (withdrawn) The method of claim 89, wherein said hole closing step comprises closing the hole in a furnace which has a temperature gradient therein.

92. (withdrawn) The method of claim 90, wherein said temperature gradient comprises a hotter zone and a cooler zone, the hotter zone located below the cooler zone, and the hole is closed by transporting said intermediate glass object from the cooler zone to the hotter zone.

93. (withdrawn) The method of claim 92, wherein said hole closure step comprises transporting said intermediate glass object through a furnace which is vertically oriented.

94. (withdrawn) The method of claim 83 wherein the intermediate glass object is a core cane.

95. (withdrawn) The method of claim 83, wherein the intermediate glass object is a glass tube onto which glass deposited inside of said tube.

96. (withdrawn) The method of claim 84, wherein, prior to said hole closure step, at least one end of said intermediate glass object is sealed.

97. (withdrawn) The method of claim 96, wherein, prior to said hole closure step, both ends of said intermediate glass object are sealed.

98. (withdrawn) The method of claim 1, wherein said step of providing the glass object comprises providing a centerline hole that is plugged at both ends thereof preventing gas flow therethrough, and wherein, prior to said applying a pressure step, one end of the glass object is opened, thereby exposing the centerline hole to said pressure.

99. (withdrawn) The method of claim 1, further comprising:

redrawing the glass object to form a core cane, and during said redrawing step

maintaining the centerline hole in the core cane;

sealing shut both ends of the cane subsequent to said redrawing step;

overlaying or depositing additional soot or glass on the outside of said core cane to form an optical fiber perform; and

positioning the optical fiber preform in a draw furnace, unsealing one end of said centerline hole prior to said drawing step, and drawing a fiber from the other end of said fiber preform.

100. (rejected) The method of claim 1, wherein said applying a pressure step comprises applying a pressure of greater than 750 Torr to the hole.

101. (rejected) The method of claim 1, further comprising drawing an optical fiber from a preform which is comprised of said intermediate glass object, and said fiber comprised of concentric layers of glass such that any glass layer between about .08 to about .15 microns from the centerline of said optical fiber exhibits a change in radial dimension around its periphery which is less than .025 microns.

102. (rejected) The method of claim 101, wherein said changed radial dimension is less than .015 microns.

## IX. **EVIDENCE APPENDIX**

None

## X. **RELATED PROCEEDINGS APPENDIX**

None